Kafkas Univ Vet Fak Derg
24 (4): 627-630, 2018
DOI: 10.9775/kvfd.2018.19663

Kafkas Universitesi Veteriner Fakultesi Dergisi
Journal Home-Page: http://vetdergi.kafkas.edu.tr
Online Submission: http://submit.vetdergikafkas.org

Case Report

Treatment of Traumatic Thoracal Instability with Pedicle Screw-Rod Fixation System in a Dog

Ahmet ÖZAK [1] Cenk YARDIMCI [1] Hatice Özlem NİSBET [1] Kamil Serdar İNAL [1]

[1] Ondokuz Mayıs University, Faculty of Veterinary Medicine, Department of Surgery, TR-55200 Samsun - TURKEY

Article Code: KVFD-2018-19663 Received: 01.03.2018 Accepted: 31.05.2018 Published Online: 01.06.2018

How to Cite This Article

Özak A, Yardimci C, Nisbet HÖ, İnal KS: Treatment of traumatic Thoracal instability with pedicle screw-rod fixation system in a dog. *Kafkas Univ Vet Fak Derg,* 24 (4): 627-630, 2018. DOI: 10.9775/kvfd.2018.19663

Abstract

In this paper, clinical and neurological results of stabilization of a thoracic fracture and luxation with a pedicle screw-rod fixation system (PSRFS) in a dog have been reported. A physical and neurological examination revealed non-ambulatory paraparasis, upper motor neuron lesions of hind limbs which localized the lesion to thoracolumbal vertebra. On the radiographic survey; lateral views of the thoracolumbal region revealed luxation between Thoracal 11-12 (Th11-12) and fracture of end plate of Th11. After laminectomy and discectomy, two Ø 3.5 mm polyaxial pedicle screws were placed to each side of Th11-12 corpus and connected with a rod. The dog was able to stand without any support and was ambulatory with assistance after 6 weeks postoperatively. Full recovery was seen and normal alignment of the luxated vertebrae and fusion was seen on radiographic views on postoperative 6th month. As a conclusion PSRFS can be successfully used in fractures/luxations of vertebras in large breed dogs. The main disadvantages of the PSRFS are higher cost, limited screw dimensions and variability of pedicle safe corridors.

Keywords: *Dog, Pedicle screw, Vertebral fracture*

Bir Köpekte Travmatik Torakal İnstabilitenin Pediküllü Vida Rod Fiksasyon Sistemiyle Tedavisi

Öz

Bu yazıda, bir köpekte torakal kırık ve luksasyonun pediküllü vida-rod fiksasyon sistemiyle stabilizasyonunun klinik ve nörolojik sonuçları bildirilmiştir. Fiziksel ve nörolojik muayenede, ambulatorik olmayan paraparazis ve arka bacaklarda torakolumbal vertebrada lokalize olan yukarı motor nöron lezyonu belirlendi. Radyografik görüntülemede; Torakal 11-12 (Th11-12) vertebra arasında luksasyon ve Th11 vertebranın son plağında kırık belirlendi. Laminektomi ve diskektomi sonrasında, iki adet Ø 3.5 mm poliaksiyal pedikül vidası, Th11-12 korpusunun her iki yanına yerleştirildi ve rod ile bağlandı. Köpek, operasyondan sonraki 6. ayda herhangi bir destek almadan ayakta durabiliyor ve yardımla gezebiliyordu, radyografide, lukse olan vertebranın hizasının normal olduğu, vertebrada füzyon ve tamamen iyileşme görüldü. Sonuç olarak, poliaksiyal pedikül vidası rod sistemi büyük ırk köpeklerde vertebra kırık ve luksasyonlarında başarılı bir şekilde kullanılabilir. Bu sistemin temel dezavantajları, maliyetinin yüksek, vida boyutlarının kısıtlı ve pedikül güvenli koridorlarının değişkenlik göstermesidir.

Anahtar sözcükler: *Köpek, Pedikül vida, Vertebra kırığı*

INTRODUCTION

Fractures, luxation and/or subluxation of vertebral column are seen frequently in companion animals [1,2]. The common causes of vertebral trauma are vehicle accident, falls, bite wounds and gun shots. In general, surgical treatment is required for these kind of traumas and several surgical techniques have been described including vertebral body plating, external splinting, spinal process plating in combination with application of a Kirschner-Ehmer apparatus, composite fixation with pins or screws and polymethylmethacrylate (PMMA), stabilization with external fixation, spinal stapling, modified segmental spinal instrumentation and tension band stabilization [3-6].

In human medicine, spinal fracture and luxation, or instability related to disk disease and spinal stenosis have been treated with surgical decompression combined with pedicle screw-rod fixation system (PSRFS) [7,8]. The primary goal of PSRFS is stabilization of decompressed spinal segments and thereby achieving bony fusion of spinal segment [7,9]. In veterinary practice PSRFS has been used

İletişim (Correspondence)
+90 362 3121919/1227
aozak@hotmail.com

for stabilization of lumbosacral junction in degenerative lumbosacral stenosis [10,11].

The purpose of this paper is to report the clinical and neurological outcomes of stabilization of thoracal fracture and luxation with PSRFS, which has been used in traumatic instability of vertebra.

CASE HISTORY

Ten months-old, male Labrador Retriever was admitted to the Department of Surgery, following a motor vehicle accident. According to the owner, following the accident the dog was ambulatory and medical treatment including corticosteroid, analgesic and B complex vitamin was performed in referral clinic, however, it soon deteriorated and became non-ambulatory. According to neurological examination, non-ambulatory paraparasis, upper motor neuron lesions of hind limbs which localized the lesion to thoracolumbal vertebra. And also presence of deep pain sensation was detected. Direct radiography was carried out under anesthesia which was provided by diazepam (0.28 mg/kg, IV, Diazem 10 mg, Deva, Istanbul, Turkey) and propofol (3 mg/kg, IV, Propofol 1% 20 mL, Fresenius, Istanbul, Turkey). On the radiograpic survey; lateral views of the thoracolumbal region revealed luxation between Thoracal 11-12 (Th 11-12) and fracture of end plate of Th 11 vertebra *(Fig. 1)*. Computed tomography views were also obtained *(Fig. 2)*. The dog received methylprednisolone (20 mg/kg, IV, Prednol-L 250 mg amp., Mustafa Nevzat, İstanbul, Turkey) and cefazolin (20 mg/kg, IV, Cefozin 500 mg, Bilim, Istanbul, Turkey) and morphine (0.01-0.02 mg/kg, IV, Morfin HCl 0.01 g/mL, Osel, Turkey) before induction of anesthesia. The dog was premedicated with acepromazine (0.025 mg/kg, IV, Calmivet Solution 5 mg/mL, Vetaquinol, Paris, France). Anesthesia was induced with propofol (3 mg/kg, IV, Propofol 1% 20 mL, Fresenius, Istanbul, Turkey) given intravenously until the desired level of induction was achieved. A size 7-cuffed endotracheal tube was inserted, and isoflurane anesthesia was maintained at 1-2% via low flow, semi-closed-circuit technique at an oxygen flow rate of 1 L/min. The dog was aseptically prepared and placed in the ventral recumbence and a dorsal approach was performed as previously described [12].

Laminectomy had been performed between Th 11-12 vertebrae and the luxation was reduced by traction of vertebral bodies with hooks. Discectomy and removal of fractured end plate of Th 11 were done. Two Ø 3.5 mm polyaxial pedicle screws were placed to each side of Th 11-12 corpus and connected with a rod *(Fig. 3)*. Cancellous bone graft, maintained from wings of ileum was placed to the intervertebral disc space.

A cast including PVC (polyvinylchloride) as a support material, which was extended from interscapular region to lumbar 5 was used for external support. The normal aligment of the vertebra was detected after the operation *(Fig. 4)*. Fentanyl (10-20 µg/kg, IV, Fantanyl 50 µg/mL, Hameln, London, United Kingdom) was applied for post-operative analgesia. Cefazolin was continued every 12 h for one week after the operation. The dog was hospitalized

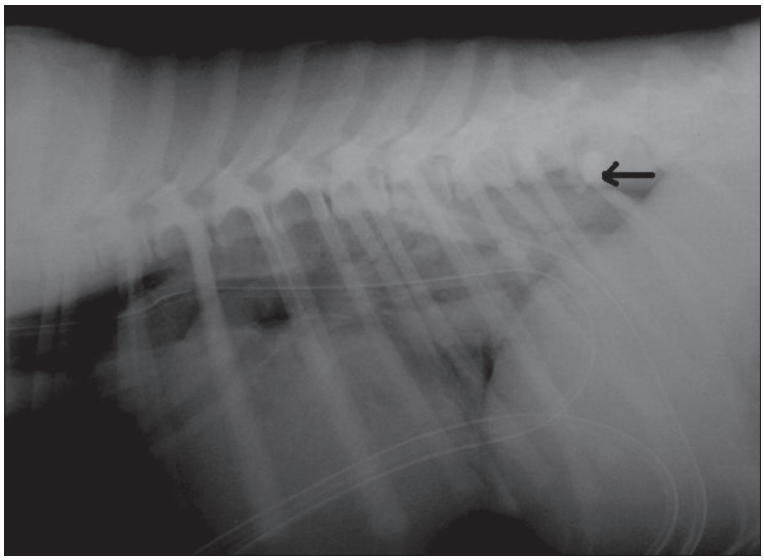

Fig 1. Lateral radiographic view of thoracolumbal vertebra. Notice the fracture and luxation of Th 11-12 *(black arrow)*

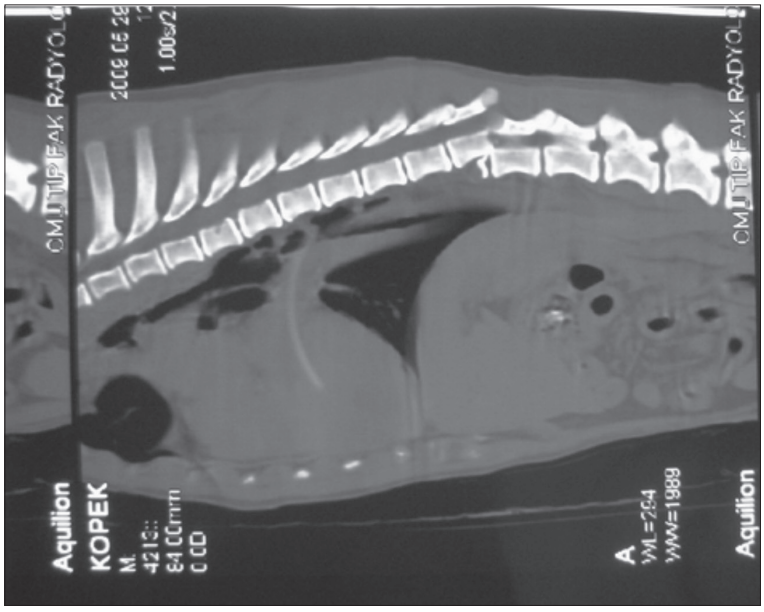

Fig 2. Sagittal computed tomography view of thoracolumbal vertebra. The luxation and fracture of end plate of Th11 is seen more obviously

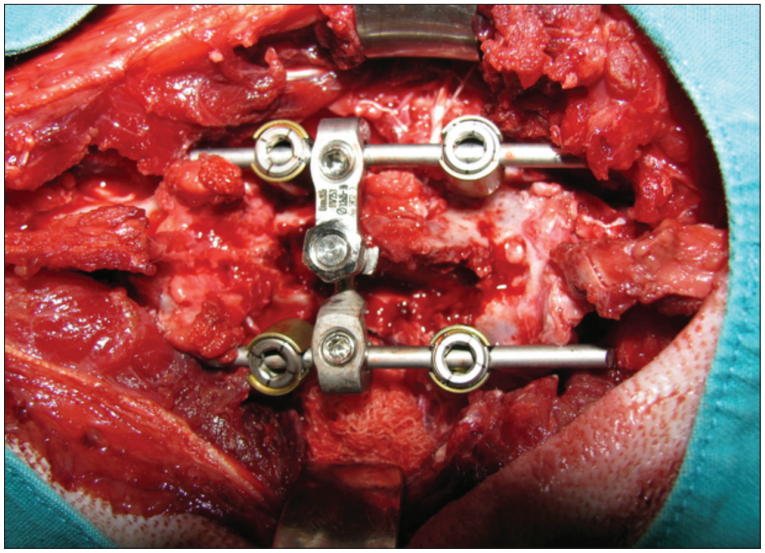

Fig 3. Dorsal view of PSRFS after it was applied

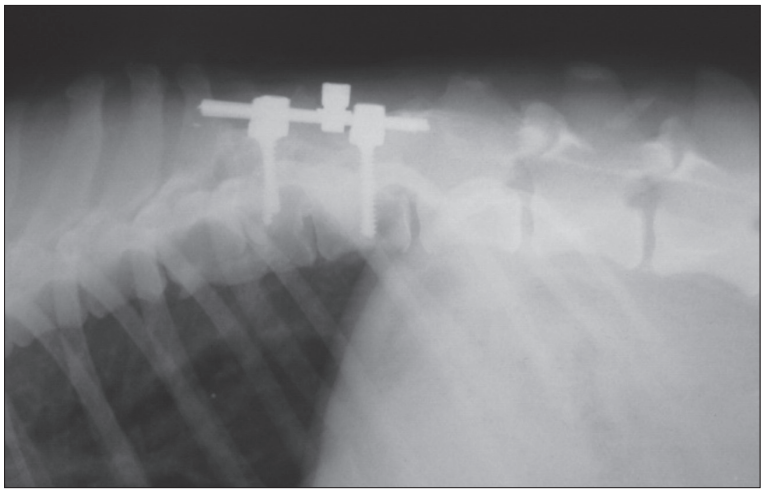

Fig 4. Lateral radiographic view of operation site after the PSRFS application

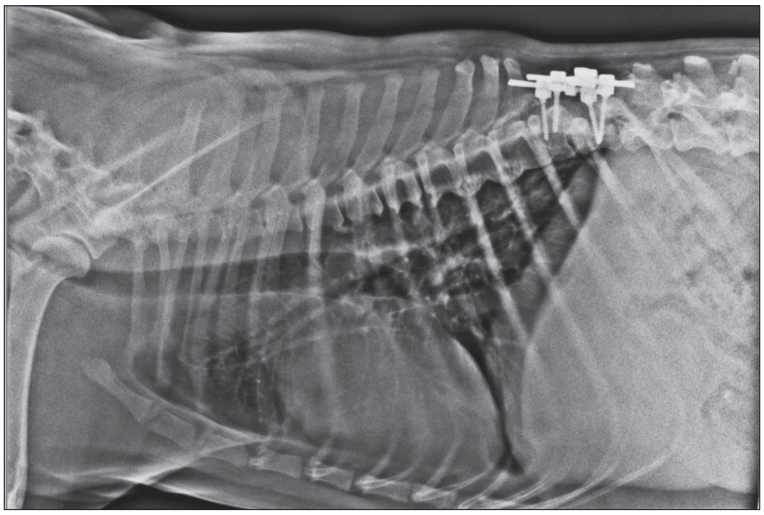

Fig 5. Lateral radiographic view of operation site on postopartive 6th month. The normal alignment of vertebra and the fusion were detected

and examined daily for 6 weeks. During hospitalization, physical therapy was carried out by placing the patient into a custom made cart and each joint of both limbs were extended and flexed through their full range of motion following a thorough hydrotherapy massage every day. This therapy was carried out on a custom made designed cart. The hind limbs were supported with a sling. The cast was changed at 10 day intervals and removed 4 weeks after the operation.

The dog was able to stand without any support and was ambulatory with assistance after 6 weeks postoperatively. However, the gait of the pelvic limbs was moderately uncoordinated. Adequate fracture healing and stable implant was detected by radiography at the end of hospitalization. Clinical, neurological and radiographic examinations were done on the third and sixth month postoperatively. On reexamination three months postoperatively, the gait had almost returned to normal, however, slight proprioceptive deficit of effect leg was detected. However, on postoperative 6th month postoperatively, full recovery and normal alignment of the luxated vertebrae and fusion was seen on radiographic views *(Fig. 5)*.

DISCUSSION

The fractures and/or luxations are generally seen at thoracolumbar region in dogs [1,5,13]. Involvement of end plate to the fracture or luxation is frequently seen in cats and dogs younger than one year. The closure of end plates in dogs is completed after 11-14 months [1]. In our case the localization of the luxation and end plate physeal fracture, and the age of the case were compatible with the reports.

In human medicine PSRFS has been used for treatment of spinal stenosis, spinal fractures/luxations, and degenerative disk disease [7,8]. The aim of the PSRFS is to improve deformity and stabilize the spine in its natural position until fusion has occurred and prevent further degenerative changes [7,9]. In veterinary literatures, PSRFS has been only used to stabilize lumbosacral region after laminectomy for treatment of degenerative lumbosacral stenosis in dogs [10,11,14,15]. Furthermore, the system was used to investigate fusion in lumbar vertebrae [16]. According to authors' knowledge PSRFS has not been used to stabilize the fracture and luxation of spine in dogs.

Several methods have been described to stabilize

the fracture and luxation of spine [3-6]. Generally at least two cranial and caudal vertebras of the fracture should be stabilized [5,6,13]. Transpedicular screw fixation maintains a rigid anchorage of the screw to the vertebral body. This anchorage enables a secure three-dimensional positional control between the screw and the longitudinal elements, which can provide a restoration of normal stiffness even in short segmental (i.e. one or two-level) instrumentation [7]. The screws were applied to the corpus vertebra of Th 11-12. According to the perioperative observation rigid fixation was achieved, even though one level instrumentation. Meij et al.[14] reported that dorsal laminectomy and partial discectomy had changed the stiffness characteristics of the spine specimen in neutral zone without changing range of motion, however, in natural cases with degenerative lumbosacral stenosis laminectomy and discectomy could decrease stiffness significantly in vivo. In the case the stiffness of the vertebral region was markedly decreased after discectomy and removal of fractured end plate. According to our perioperative observation it was determined that stiffness of fractured region has been obtained after application of PSRFS.

PSRFS has been designed for human vertebras, so the dimensions of the screws are not suitable even for large breed dogs. The use of pedicle screws for adult humans led to fracture of the lateral and the medial wall of the pedicle. Pedicle screws for pediatric patients better fit for adult canine vertebral pedicle [14]. The pediatric pedicle screws which is Ø 3.5 mm diameter were successfully used for the dog in this case and it was determined that pediatric PSPFS systems are suitable for large breed dogs

The dimensions and shapes of the vertebras are differed even though in same breed animals. This is the main problem for safe screw insertions and prediction of the screw dimensions [17]. Smolders et all indicated that CT- and/or MRI- based evaluation of the vertebral dimensions of both L7 and S1 is necessary for optimal screw insertion corridors for individual dogs [15]. Before the surgery CT images had been evaluated for pedicle dimensions to predict the dimension of screws dimensions. Because, in human PSRFS the dimensions of the screw are limited for animals and eventually, Ø 3.5 mm diameter screws which are pediatric for human patients were used according to evaluation of CT images.

The fracture healing was detected at the end of hospitalization by radiographic examination which is consisted with spinal fractures can heal in as short as a time as 4 weeks [4].

As a conclusion PSRFS can be successfully used in fractures/luxations of vertebras in large breed dogs. The main disadvantages of the PSRFS are higher cost, limited screw dimensions and variability of pedicle safe corridors. Further studies with large amount of cases with fractures/luxations of vertebras will give more successful and supportive information for the usage of PSRFS in veterinary neurosurgery.

REFERENCES

1. Bali MS, Lang J, Jaggy A, Spreng D, Doherr MG, Forterre F: Comparative study of vertebral fractures and luxations in dogs and cats. *Vet Comp Orthop Traumatol,* 22 (1): 47-53, 2009.

2. Bruce CW, Brisson BA, Gyselinck K: Spinal fracture and luxation in dogs and cats. *Vet Comp Orthop Traumatol,* 21 (3): 280-284, 2008. DOI: 10.1055/s-0037-1618862

3. Bruecker KA: Principles of vertebral fracture management. *Semin Vet Med Surg (Small Anim),* 11 (4): 259-272, 1996.

4. Shores A, Nichols C, Rochat M, Fox SM, Burt GJ, Fox WR: Combined Kirschner-Ehmer device and dorsal spinal plate fixation technique for caudal lumbar vertebral fractures in dogs. *J Am Vet Med Assoc,* 195 (3): 335-339, 1989.

5. Voss K, Montavon PM: Tension band stabilization of fractures and luxations of the thoracolumbar vertebrae in dogs and cats: 38 cases (1993-2002). *J Am Vet Med Assoc,* 225 (1): 78-83, 2004. DOI: 10.2460/javma.2004.225.78

6. Wheeler JL, Lewis DD, Cross AR, Sereda CW: Closed fluoroscopic-assisted spinal arch external skeletal fixation for the stabilization of vertebral column injuries in five dogs. *Vet Surg,* 36 (5): 442-448, 2007. DOI: 10.1111/j.1532-950X.2007.00290.x

7. Boos N, Webb JK: Pedicle screw fixation in spinal disorders: A European view. *Eur Spine J,* 6 (1): 2-18, 1997. DOI: 10.1007/BF01676569

8. Yahiro MA: Comprehensive literature review: Pedicle screw fixation devices. *Spine,* 19 (20-Suppl.): 2274S-2278S, 1994.

9. Davne SH, Myers DL: Complications of lumbar spinal fusion with transpedicular instrumentation. *Spine,* 17 (6-Suppl.): S184-S189, 1992. DOI: 10.1097/00007632-199206001-00021

10. Méheust P: Une nouvelle technique de stabilisation lombosacrée: l'arthrodèse par vissage pédiculaire, étude clinique de 5 cas. *Prat Med Chir Anim Comp,* 35, 201-207, 2000.

11. Méheust P, Mallet C, Marouze C: Une nouvelle technique de stabilisation lombosacrée: L'arthrodèse par vissage pédiculaire. Considérations anatomiques. *Prat Med Chir Anim Comp,* 35, 193-199, 2000.

12. Piermattei DL, Johnson KA: The Vertebral Column. **In,** Piermattei DL, Johnson KA (Eds): An Atlas of Surgical Approaches to the Bones and Joints of the Dog and Cat. 4th ed., 78-83, Saunders Philadelphia, New York, 2004.

13. Krauss MW, Theyse LFH, Tryfonidou MA, Hazewinkel HAW, Meij BP: Treatment of spinal fractures using Lubra plates. A retrospective clinical and radiological evaluation of 15 cases. *Vet Comp Orthop Traumatol,* 25 (4): 326-331, 2012.

14. Meij BP, Suwankong N, Van der Veen AJ, Hazewinkel HAW: Biomechanical flexion-extension forces in normal canine lumbosacral cadaver specimens before and after dorsal laminectomy-discectomy and pedicle screw-rod fixation. *Vet Surg,* 36 (8): 742-751, 2007. DOI: 10.1111/j.1532-950X.2007.00331.x

15. Smolders LA, Voorhout G, van de Ven R, Bergknut N, Grinwis GCM, Hazewinkel HAW, Meij BP: Pedicle screw-rod fixation of the canine lumbosacral junction. *Vet Surg,* 41 (6): 720-732, 2012. DOI: 10.1111/j.1532-950X.2012.00989.x

16. Mutlu Z, Devecioglu Y, Demirutku A, Aktas M, Eravci E, Duzgun O: The use of polyaxial pedicle screw for the fusion of lumbar vertebra in sheeps. *J Anim Vet Adv,* 10 (9): 1202-1204, 2011. DOI: 10.3923/javaa.2011.1202.1204

17. Watine S, Cabassu JP, Catheland S, Brochier L, Ivanoff S: Computed tomography study of implantation corridors in canine vertebrae. *J Small Anim Pract,* 47 (11): 651-657, 2006. DOI: 10.1111/j.1748-5827.2006.00070.x